SCIENCE EQUIPMENT AND MATERIALS FOR A COMPREHENSIVE ELEMENTARY SCIENCE PROGRAM WITH A PLAN OF PURCHASE

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THE PROBLEM AND DEFINITION OF TERMS

Schools have always been faced with the problem of how best to spend their available funds in every area. The expenditure of funds for elementary science equipment has been particularly confusing in that there are those who would use only what students can bring to class and those who would buy everything. Many times an item which has little use is purchased because there is a lack of information of the relative importance of suggested items for the elementary science program. It is hoped that the following paper will provide a guide to assure better planned purchases.

THE PROBLEM

Statement of the problem. It was the purpose of this study (1) to provide a list of science equipment and materials for a comprehensive elementary science program; (2) to arrange this equipment and the materials in the order of their importance to the elementary science program; and (3) to set up criteria in the selection and purchase of this equipment and materials.

Importance of the study. In view of the great increase in scientific knowledge in the past few years and the great publicity given to science through the space

program, schools find themselves pressed by their constituents to provide better science programs. As to the importance of equipment and materials in providing these better science programs, Navarra and Zafforoni say, "The greatest single deterrent to the effective development of an elementary science program is the lack of information and understanding as to how to acquire and to use the right kind of facilities and materials."[1] Title III of the National Defense Education Act has given virtually twice the funds to public schools to spend for permanent science equipment and although lists of equipment eligible for purchase under this act have been provided there are no directions in these lists of which to buy first, second, or third. Private schools, who may only borrow money under Title III, have a still greater problem in selection of equipment and materials because they will have to someday repay the loan. Even though more money is available than before, a wise use of these funds is to be desired.

Many studies have been done in the teaching of science, but according to Jacqueline Mallinson, most of these have concerned themselves with what is being done and not

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[1]John Gabriel Navarra and Joseph Zafforoni, Science Today for the Elementary School Teacher. Evanston, Illinois: Row, Peterson, and Company, 1960, p. 27.

with what ought to be done.[2] The Encyclopedia of Educational Research makes the following statement concerning the need for research in this area:

> Periodical literature includes a relatively large number of articles discussing various aspects of science facilities. Although many of these are sound treatments and apparently contain many excellent ideas which might be advantageously employed by the science teacher, in general they reflect the considered judgment and experiences of the writers rather than the objectively validated finding of the research.[3]

DEFINITION OF TERMS

Equipment. Equipment was interpreted as those items needed for science demonstrations and experiments which are not readily consumed. It did not include equipment which has use outside of the science program such as recorders or projectors.

Materials. The term, materials, was defined as those substances which are consumed in the demonstrations and experiments. Materials did not include films, film-

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[2]Jacqueline Buck Mallinson. "What Research in Science Education is Needed to Strengthen the Elementary School Science Program?" Science Education, XL (December, 1957), p. 369-371.

[3]Chester W. Harris, (ed.). Encyclopedia of Educational Research. Third Edition. New York: The Macmillan Company, 1960, p. 1227.

strips, textbooks, library books, or teacher reference materials.

Elementary. By elementary was meant grades one to eight. This designation was selected because the researcher wished to use this report in work in parochial schools of which the majority have this grade arrangement.

THE NECESSITY OF EQUIPMENT AND SUPPLIES FOR THE SCIENCE PROGRAM

Every comprehensive program needs equipment. It may seem self-evident to many that the successful science program needs equipment to be adequate, but there are also some who would not use much equipment. It is certain that there is more to a comprehensive science program than excellent equipment such as well-prepared teachers, adequate texts, library resource materials, and audio-visual equipment and materials. However, the Council of State School Officers includes with some of the above, "a supply of appropriate materials, apparatus, and equipment."[4]

Tannenbaum and Stillman reiterate this with these words:

> To teach science, teachers need clear, specific objectives; they need sound teaching techniques; they need methods of evaluating what they have taught. But they also need tools. The tools of teaching are those materials with which the teacher brings his program to life. They are the materials with which he builds a vital, individualized, and meaningful program. He needs: (1) special science equipment which is simple yet adequate.[5]

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[4]Purchase Guide for Programs in Science, Mathematics, Modern Foreign Languages. Council of Chief State School Officers. Chicago: Ginn, 1959, p. 252.

[5]Harold E. Tannenbaum, and Nathan Stillman. Science Education for Elementary-School Teachers. Boston: Allyn and Bacon, Inc., p. 267-268.

Teachers need this equipment for a means of bringing science experiences and understanding to the child. The equipment or the experiment performed with it is not the final goal, but it is only a means of attaining the ends, children who understand science and are enthused about it.

Speaking of materials Navarra and Zafforoni say, "Their chief purpose is to implant ideas in the minds of children and to help them understand scientific concepts."[6]

Not only should teachers be using equipment to do demonstrations and thereby enhance their teaching, but the children also should have opportunities to observe and describe the world around them, seek explanations, and make predictions.[7]

Piltz says this in a slightly different way when he states, "In learning science, children plan, discuss, read, report, and listen, but these alone do not add up to effective science teaching. The vital elements are experimenta-

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[6]Navarra, op. cit., p. 27.

[7]P. E. Blackwood. "Teaching Elementary Science", School Life, XLIII (February, 1961), p. 13

tion and demonstration."[8]

A comprehensive science program then does need equipment and materials. The purpose of these is not, however, to be display, but they should find use in making a living science program with teacher demonstrations and student experiments. The main purpose of this paper is not to convince the reader that there is a need for just any equipment. "Little can be gained from a random collection of gadgets and tools that are used only in purposeless demonstration."[9] The purpose is to help teachers and administrators to know what to buy and collect.

Type of program determines particular need. What is taught in the science program and how it is taught determines in part ones needs. It would not be educationally sound to buy a certain piece of equipment or a science kit and then build a program around the purchase. Again, if one is going to study a certain field some items may need to be purchased while others might be constructed. In the study of weather it would be possible to construct a wind

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[8]Albert Piltz. Science Equipment and Materials for Elementary Schools - Suggestions for Supervisors, Administrators, and Teachers. United States Department of Health, Education, and Welfare, OE 29029. Washington: Government Printing Office, 1961, p. 20.

[9]Navarra, loc. cit.

vane but not an adequate thermometer. Other considerations which will make a difference in the equipment needed are grade level, geographical location, textbook, availability of utilities in the classroom, and the ingenuity of the teacher. Equipment suitable for individual experimentation may not be suitable for group demonstration because it is too small to be seen by a large group. Therefore, what is taught and how it is taught are important factors in the selection of needed equipment and materials.[10]

"Each school must define its own objectives before making decisions concerning equipment and materials."[11]

Quality of the teaching determines the usefulness of equipment. Although there is a need in the science program for equipment and materials, the quality of the program still depends ultimately on the teacher. The best equipment can be rendered useless by the teacher who does not use it or uses it only to entertain. Piltz expresses this idea with these words. "The significant factors in a good science-learning activity are the teacher and the quality and kind

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[10]Piltz, loc. cit.

[11]Ibid., p. 1.

of activities the pupils engage in each day."[12] "The task of the teacher is therefore to use materials as a path to an ultimate conclusion rather than as an end in themselves."[13]

PROCEDURES USED

Educational literature was searched for lists of equipment and materials considered important for the teaching of elementary science by science educators and departments of education. Departments of education, both state and local, were contacted for any lists of this nature that they might have developed. Textbook publishers were asked for a list of materials needed in the teaching of their particular text. Of these lists obtained fifteen were used: five lists by science educators, five lists by textbook publishers, and five lists by state and local departments of education. Of those lists available to the researcher the more comprehensive lists were used. The researcher then made a master list of all items found in any one of these separate lists and tallied any duplicates.

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[12] Ibid., p. 7.

[13] Philip G. Johnson, "National Developments in Science Curriculum in Elementary and Junior High," School Life, XLV (October, 1962), p. 20.

When the tally was made, there were times when the researcher had to make judgments as to where to place an item. There were a few times when objects with different names were judged to be essentially the same and were scored the same. An example of the foregoing was that some lists called the item a hand magnifier and other lists called the item a reading glass. These items were combined under one name.

Those items which appeared in the greatest number of lists were then placed first in each of the sub-groups of equipment and materials with the supposition that the items considered important by the greatest number should be purchased first.

Table I gives to the reader at a glance the sources of the lists of science equipment and materials which were used in preparing the master list. The table also shows the sameness and differences in the specified categories of the lists. It is interesting to note that all but two include an aquarium and all but five lists include one or more terrariums for an adequate science program.

From Table I it is evident that science educators suggest fewer purchased materials and the textbook companies suggest an average of eighty more items than the

science educators. The fifteen lists are most similar in suggested number of glassware items.

TABLE I

COMPARISON OF LISTS USED IN DEVELOPING MASTER LIST OF SCIENCE EQUIPMENT AND MATERIALS

	Apparatus	Terrarium	Aquarium	Metal Ware	Glassware	Chemicals and Related Items	Other Items	Tools
Science Educators								
Blough	7	0	0	8	15	12	39	1
Burnett	17	0	1	3	8	14	28	13
National Science Teachers Assn.	47	2	2	8	19	1	34	1
Navarra	59	0	1	3	24	6	69	14
Tannenbaum	87	2	1	12	26	70	110	12
State Lists and City Lists								
Council of Chief State School Officers	118	3	1	7	22	0	39	1
Illinois	88	2	1	9	32	5	55	1
New York	39	1	1	6	17	31	124	13
Utah	101	3	1	6	17	0	42	21
Detroit, Michigan	26	1	0	7	20	21	29	11
Textbook Publishers								
ABC	49	0	1	10	29	46	146	8
Ginn	49	1	1	9	18	45	151	11
Heath	38	0	1	10	17	38	129	8
Macmillan	45	2	1	3	15	59	42	8
Singer	31	1	1	10	16	17	126	5

LISTS OF EQUIPMENT AND SUPPLIES

In order that the reader might know and understand the source and purpose of the lists, the following discussion seems important.

Among lists of science equipment and materials developed by science educators the following were used:

1. A list by Glenn Blough, Specialist in Elementary Science, U. S. Office of Education and Marjorie H. A. Campbell, Consultant in Elementary Science and Television, District of Columbia Public Schools, from their book, Making and Using Classroom Science Materials in the Elementary-School. Although in this book the authors emphasize the making of materials and equipment, "there are some essential pieces of equipment that should be purchased."[14] This is a very basic list.

2. A list by R. Will Burnett, Professor of Science Education, University of Illinois, Science Editor, World Book Encyclopedia, from his book, Teaching Science in the Elementary-School. This list is a minimal list containing mostly equipment and materials that will need to be purchased.

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[14]Glenn O. Blough and Marjorie H. A. Campbell. Making and Using Classroom Science Materials in the Elementary School. New York: Dryden Press, 1954, p.35.

3. A list from School Facilities for Science Instruction, Second Edition, National Science Teachers Association, 1961. This contains those items only which have to be purchased from science supply houses.

4. Two lists by John Gabriel Navarra, Chairman, Department of Science, Jersey City State College and Joseph Zafforoni, Associate Professor, Teachers College, University of Nebraska, from their book, Science Today for the Elementary-School Teacher. In describing these lists which the researcher used together as one list, the authors make the following statements. "During the course of a year, most teachers have had a need for such materials in the activities planned with and for children. This is a minimum list and is only suggestive."[15] "The following list is included here to assist the classroom teacher who wishes to order elementary science materials from a scientific supply house. Keep in mind that it is only a suggested list. It is not a complete one."[16]

5. A list by Harold E. Tannenbaum, Professor of Science Education, State University College of Education,

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[15] John Gabriel Navarra and Joseph A. Zafforoni. Science Today for the Elementary-School Teacher. Evanston, Illinois: Row, Peterson, and Company, 1960, p. 41.

[16] Ibid., p. 49.

New Paltz, New York, and Nathan Stillman, Professor of Education, Director of the Child Study Center of the same College was taken from their book, Science Education for Elementary School Teachers. They state that the teacher must have a reservoir of science materials from which he can draw as he carries out his program and that their list is a source of such materials.[17]

Among the lists of science equipment and materials developed by state and city departments of education the following were used:

1. A list by the Council of Chief State School Officers from the book, Purchase Guide for Programs in Science, Mathematics, Modern Foreign Languages.

2. A list from the State of Illinois, Office of the Superintendent of Public Instruction, Ray Page, Superintendent.

3. A list from the New York State Education Department, Bureau of Curriculum Development. This list includes those items only for grades kindergarten to six.

4. A list from the Utah State Department of Education.

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[17]Harold E. Tannenbaum and Nathan Stillman. Science Education for Elementary School Teachers. Boston: Allyn and Bacon, Inc., 1960, p. 269.

5. A list from the Exact Science Department, Division of Instruction, Detroit Public School.

The lists developed by Illinois and Utah were developed to help teachers in the selection of equipment and materials suitable for purchase under Title III. The list of the Detroit Public Schools was used as a requisition form. This Detroit list was found in Appendix II and the New York list was found in Appendix III of Science Equipment and Materials by Albert Piltz.

Among lists of science equipment and materials needed in the teaching of particular elementary science textbook series the following were used:

1. ABC Science Series by Jacobson and Lauby. The American Book Company provided the list.

2. Science Today and Tomorrow by Craig and others. Ginn and Company provided the list.

3. Heath Science Series by Herman and Nina Schneider. D. C. Heath and Company provided lists, one for each grade, one to six, which were then unified to avoid repetitions.

4. Science/Life Series by Barnard and others. The publisher, Macmillan, has no lists published but directed the researcher to the lists in the teachers manuals for each unit. These lists were then unified.

5. Singer Science Series by Frasier and others. The

L. W. Singer Company provided the list.

In all lists by textbook publishers there were many entries of environmental materials necessary for the teaching of their particular text. However, there was considerable overlap between companies.

The reader may wonder why a list from the State Department of Public Instruction of Kansas was not used. The researcher did write to the State Department of Public Instruction for such a list, but he received only some general directions concerning Title III purchases. When G. W. Reida, School Facilities Services, State Department of Public Instruction, Topeka, was contacted in 1958 by the United States Office of Education, he replied, "Our State legislature has never taken any action regarding any codes for furniture and equipment for science and mathematics."[18] It is assumed, since no other communication was received, this situation still exists.

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[18]Edgar W. Martin. Facilities and Equipment for Science and Mathematics - Requirements and Recommendations of State Departments of Education. United States Department of Health, Education, and Welfare, OE 21000. Washington: Government Printing Office, 1960, p. 27.

MASTER LIST OF EQUIPMENT AND SUPPLIES

Introduction to lists. The following list is a complete list of all items as found in the fifteen lists combined. It is not intended to indicate that all items are needed by a school in order to have a comprehensive science program.

The column headed Number refers to the number of lists on which the item was found. For instance, the number following the item, compound bar, is seven which indicates that seven of the fifteen lists considered this item as useful or needed in an elementary science program.

In the price column is an approximate price for the item if purchased from a science supply house. Catalogues from Central Scientific Company, Welch Scientific Company, Fisher Scientific Company, and others were used. It is possible that the price is not always the lowest price you might have to pay. In the chemical section the price is always the technical grade if it was available.

APPARATUS

	Number	Price
Apparatus for the Study of Heat		
Compound Bar	7	$ 1.00
Radiometer	6	7.75
Conductometer	5	1.50
Ball and ring	5	3.00
Convection apparatus, gases	3	6.50
Convection apparatus, liquids	3	1.45
Thermostat	3	3.50
Firemaking syringe	2	18.95
Pulse glass, large form	2	2.10
Apparatus for the Study of Light		
Mirror, plane	13	$ .30
Prism, glass	11	2.85
Lens demonstration set	9	5.25
Camera	5	Varies
Mirror, concave	5	1.75
Mirror, convex	5	1.75
Camera, pinhole	4	5.75
Color disks with motor	4	22.50
Prism, lucite	1	12.00

Apparatus for the Study of Sound or Communication		
Tuning forks	11	$ 3.70
Receiver, telephone	5	3.80
Telegraph key	5	10.25
Earphones	4	3.50
Telegraph sounder	4	13.00
Transmitter, telephone	4	4.00
Crystal, Germanium diode	2	1.45
Galton's whistle	2	11.50
Megaphone	2	Varies
Radio	2	65.00
Tuning fork, adjustable	1	5.65
Variable condenser, crystal, Galena	1	7.50

Apparatus for the Study of Static and Current Electricity		
Bell, electric	13	$ 1.35
Light sockets, miniature	13	.40
Switch, push-button	11	.75
Dry cells	10	1.40
Switch, knife	10	.35
Friction rod, glass	8	1.10
Pith balls	8	.80
Friction rod, rubber	7	.70
Light bulbs, miniature	7	.40
Fan, electric	6	Varies

Galvanometer	6	$ 4.35
Electric motor, battery	5	4.00
Electric motor, St. Louis	5	11.75
Electroscope, flask-form	5	2.70
Power supply, low-voltage	5	3.00
Tree lights, Christmas	4	Varies
Batteries, flashlight	3	.25
Buzzer, electric	3	1.25
Electrolysis apparatus, Hoffman	3	16.50
Volt-ammeter, battery test meter	3	79.50
Coil, antenna	2	2.00
Flashlight cell holder	2	.45
Clips, Fahnestock	1	.20
Electric plug	1	.22
Electric wall receptacle	1	.85
Rheostat	1	12.50
Spark coil	1	11.95
Switches, assorted	1	1.50
Volt meter	1	24.50

Apparatus for the Study of Weather and Air Pressure		
Barometer, aneroid	13	$ 19.50
Barometer, mercury	10	28.50
Anemometer	6	39.00
Gyrometer	5	10.00
Hygrometer, sling psychometer	4	14.95
Cloud apparatus	3	4.50
Altimeter, auto-type	2	9.35
Wind vane	2	16.00
Anemometer, portable	1	6.85
Anemometer, weather-instrument type	1	9.50
Barograph	1	175.00

Balances and Springs		
Balance, spring	12	$ 2.50
Weights, set of avoirdupois	8	6.85
Balance, single beam	7	25.00
Scale, kitchen or household	6	7.85
Weights, set of metric	6	12.00
Balance, triple beam	5	23.00
Scale, bathroom	4	27.95
Balance, dial spring	3	2.65
Balance, hand	1	4.75
Balance, spring, heavy-duty	1	5.00

Equipment for the Collecting and Keeping of Animal and Plant Life

Aquarium	13	$ 15.00
Terrarium and/or Vivarium	10	25.00
Cage, animal	9	15.00
Cage, insect	8	12.00
Net, insect	7	4.50
Ant nest, observation	6	7.25
Aquarium aerator	5	15.50
Aquarium heater	4	9.45
Dissecting set, student	4	2.50
Flower press	3	5.35
Germinating box	3	4.50
Net, towing	3	Varies
Vasculum	3	5.50
Bee hive, observation	2	39.50
Board, dissecting	2	1.25
Board, spreading, insect	2	2.00
Mounts, Riker, botanical	2	.60
Aquarium aerator valve	1	1.00
Aquarium dip net	1	.50
Cage, animal, collapsible	1	27.50
Cage, insect specimen, storage	1	1.75

Light Sources

Flashlight	11	$ 2.50
Lamp, desk	5	Varies
Illuminator, microscope	2	6.00
Light, flourescent	2	3.35
Lantern, electric, large	1	Varies
Light source, ultraviolet	1	6.75

Magnets

Compass	15	$ 1.00
Magnet, bar steel	12	1.20
Magnet, horseshow steel	12	1.20
Electromagnet	9	4.45
Magnet, bar alnico	5	2.25
Magnet, bar cylindrical alnico	5	1.10
Magnet, horseshoe alnico	5	1.60
Magnet, natural (lodestone)	5	.60
Magnet, U-shaped steel	4	2.25
Magnetic needle, mounted	3	1.95
Magnet, wobbly bar	3	3.25
Dipping needle	2	9.35
Magnetizer	2	29.50
Terrella, or magnetic globe	2	13.75
Earth Inductor, rotator type	1	44.50
Magnetic field	1	2.40

Magnifiers

Reading glass	15	$ 3.00
Microscope, elementary	12	39.85
Binoculars	7	33.00
Telescope, refracting	5	124.00
Microprojector	4	174.00
Magnifier, dissecting	3	2.25
Magnifier, pocket, folding	3	.75
Magnifier, Coddington	2	8.00
Magnifier, tripod	2	1.35
Telescope, reflecting	1	38.75

Maps, Globes, and Planetariums

Globe, terrestial	9	$ 13.00
Globe, Hall tellurian	5	14.95
Planetarian, Trippensee, hand-driven	4	38.50
Map, U. S. relief	3	Varies
Globe, celestial	2	19.95
Map, North America	2	Varies
Map, U. S. political	2	Varies
Map, blackboard	1	Varies
Map, U. S. weather	1	1.45

Miscellaneous Apparatus

Rubber tubing	13	$ .25/ft.
Corks	12	1.85/100
Pulleys	12	.80
Rubber stoppers	12	1.30/lb.
Support, test tube	10	2.75
Mat, asbestos	7	.27
Silk, for electrification of rods	7	.70
Brush, test tube	6	.13
Catskin	4	3.75
Incubator, egg	4	38.50
Gyroscope	4	2.20
Laboratory wagon	4	42.50
Atoms and molecules, magnetic	3	Varies
Rotator, hand-driven	3	42.50
Autoclave, steam pressure	2	22.50
Center of gravity set	2	2.75
Gyroscope with Gimbal rings	2	67.50
Pins, insect	2	.65/100
Support stand, wooden	2	1.50
Cartesian diver	1	2.15
Density cylinder	1	.35
Gyroscope with counterpoise	1	48.50
Hydrometer	1	3.00
Inclined plane with Hall's carriage and scale pan	1	18.50

Lens paper	1	$ .20
Microscopic slide box	1	3.05
Rubber dam	1	.50
Support, test tube, polyethylene	1	1.90
Pumps		
Pump, force air	10	$ 2.55
Pump, vacuum	4	14.50
Pump, Wagner with pump plate	2	87.50
Sources of Heat		
Hot plate	15	$ 5.00
Bunsen burner and/or propane torch	13	.75
Candles	11	Varies
Alcohol burner and/or lamp	10	11.00
Thermometers		
Thermometer, F, unmounted	9	$ 1.94
Thermometer, clinical	8	1.49
Thermometer, F, large, unmounted	7	.95
Thermometer, outdoor weather	5	.95
Thermometer, C, unmounted	4	1.94
Thermometer, cooking	3	1.00
Thermometer, dial	3	8.75
Thermometer, F and C combined	3	2.90

Thermometer, alcohol	2	$ .95
Thermometer, maximum and minimum	2	8.50
Thermometer, soil	1	9.75

Timers and Clocks

Stop watch	10	$ 29.50
Clock, alarm	2	Varies
Clock, electric	2	Varies
Timer, interval, spring-wound	2	10.55
Stop watch, electric	1	50.00

CHARTS AND POSTERS

Chart, astronomy	8	$ 7.00
Chart, elements	3	2.75
Chart, geology	3	Varies
Chart, life history and habitat	3	5.00
Chart, periodic, long-form	3	14.75
Magne-poster, earth and moon	3	Varies
Magne-poster, planets	3	Varies
Chart, dental	1	Varies

CHEMICALS

Iron filings	12	$ .85/lb.
Paraffin	12	.16/lb.
Sodium chloride (salt)	12	.10/lb.
Litmus paper	10	.08/100
Cornstarch	9	.29/lb.
Lime tablets for limewater	9	.75/100
Sodium bicarbonate (baking soda)	9	.96/lb.
Copper sulfate crystalline	8	1.25/lb.
Iodine, crystalline	8	1.92/4 oz.
Sugar	8	.10/lb.
Calcium carbonate (marble chips)	3	.56/lb.
Ferric chloride	3	1.30/lb.
Fertilizer	3	Varies
Acid, acetic, 36%	2	1.10/pt.
Borax	2	.78/lb.
Brom thymol blue	2	1.20/4 oz.
Coal	2	Varies
Dry ice	2	Varies
Fehling's solution, A and B	2	1.75/lb.
Ferric oxide	2	1.10/lb.
Formaldehyde, 40% solution	2	.90/pt.
Lead nitrate	2	1.60/lb.
Manesium ribbon	2	1.55/roll

Manganese dioxide, powdered	2	$ .93/lb.
Mercuric oxide	2	14.50/lb.
Milk of magnesia	2	.50
Pepsin	2	.85/oz.
Phenolphthalein solution	2	.85/4 oz.
Potassium chlorate	2	1.15/lb.
Potassium permanganate	2	2.32/lb.
Rosin	2	.90/lb.
Acetone	1	.68/pt.
Agar Agar	1	6.40/lb.
Alcohol, ethyl, denatured	1	.80/pt.
Ammonium dicromate	1	1.71/lb.
Aluminum potassium sulfate	1	1.25/lb.
Aluminum strip	1	.60/sq. ft.
Asbestos	1	1.25/lb.
Bacteria culture	1	Varies
Benzine	1	.69/pt.
Brass strip	1	2.80/sq. ft.
Calcium nitrate	1	2.01/lb.
Calcium orthophosphate	1	1.25/lb.
Calcium sulfate	1	.90/lb.
Camphor	1	3.15/lb.
Carbon dioxide	1	10.50/.5 lb.
Carbon disulfide	1	1.00/pt.
Carbon rod	1	.15/each

Castor oil	1	1.10/lb.
Cupric oxide	1	1.50/lb.
Ether	1	1.55/lb.
Ferric ammonium citrate	1	2.00/lb.
Ferric orthophospate	1	3.75/lb.
Ferric sulfate	1	2.22/lb.
Glycerin	1	1.90/pt.
Granite	1	Varies
Gum arabic	1	1.20/lb.
Lampblack	1	1.35/lb.
Lead	1	1.60/lb.
Lead metal, granular	1	1.90/lb.
Linseed oil	1	1.85/qt.
Lugel's solution	1	1.00/4 oz.
Magnesium sulfate (epsom salt)	1	.95/lb.
Merthiolate	1	Varies
Napthaline flakes (moth balls)	1	.65/lb.
Nickel sulfate	1	1.35/lb.
Penicillin	1	Varies
Potassium bitartrate (cream of tartar)	1	1.45/lb.
Potassium ferric cyanide	1	1.50/lb.
Potassium nitrate	1	1.00/lb.
Potassium orthophosphate	1	1.35/lb.
Potassium sodium tartrate (Rochelle salt)	1	1.50/lb.
P. T. C. taste papers	1	Varies

Shale	1	$ Varies
Sodium bicarbonate, pure	1	1.02/lb.
Sodium carbonate (washing soda)	1	.85/lb.
Sodium chloride coarse (rock salt)	1	.60/lb.
Sodium thiosulfate	1	1.96/lb.
Strontium nitrate	1	1.50/lb.
Sulfur, siblimed	1	1.40/lb.
Tin metal, mossy	1	3.35/lb.
Zinc chloride	1	1.25/lb.
Zinc metal, mossy	1	2.83/lb.

DEMONSTRATION EQUIPMENT AND MODELS

Demonstration, steam engine	6	$16.95
Model, gasoline engine	6	28.50
Cell, student demonstration	5	3.65
Model, force pump	5	2.55
Model, lift pump	5	2.75
Demonstration, generator	4	21.50
Model, simple machines	3	Varies
Model, airplane	3	1.50
Model, ear	3	45.00
Model, eye	3	44.00
Model, human skeleton	3	22.50
Model, human torso	3	75.00
Model, diesel engine	2	117.50

Model, dinosaur	2	$
Model, flower	2	75.00
Model, leaf	2	42.50
Model, lung	2	73.50
Model, magnet	2	19.95
Model,stem dicotyledon	2	56.75
Model,stem monocotyledon	2	54.75
Model, sun dial	2	7.50
Demonstration, manometer	1	22.50
Motor assembly kit	1	3.00

GLASSWARE

Beakers, Pyrex, assorted	13	$ .60
Cylinders, graduated	11	1.90
Medicine dropper	11	.50
Slides, microscopic, plain	11	1.50/box
Glass tubing	10	.75/lb.
Test tubes	10	.10
Flasks, Erlenmeyer	9	.60
Funnels	9	.75
Petri dishes	9	.60
Lamp chimneys	8	.65
Flask, Florence	7	.86
Glass rods	7	.95/lb.
Jar, battery	7	1.46

Jar, bell	7	$ 10.00
Thistle tube	7	.50
Bottles, assorted	6	Varies
Bottles, wide-mouth	6	Varies
Dish, evaporating	6	.90
Window glass panes	6	Varies
Slide, cover, microscopic	5	2.30
Watch glasses	5	.14
Crucible	4	.63
Baking dishes, Pyrex	3	Varies
Glass panels, colored	3	2.45
Glass, Y-tube	3	3.78
Mortar, porcelain with pestle	3	15.67
Bottle, vacuum	2	2.50
Dish, borosilicate, large	2	1.28
Dish, laboratory plastic	2	1.85
Jars, museum	2	2.54
Slide, microscopic, prepared botany	2	1.25
Slide, microscopic, prepared zoology	2	1.25
Bottle, insect killing	1	.45
Bottle, homeopathic	1	.60
Burette	1	6.80
Dish, staining	1	1.10
Glass tank	1	3.75

Pipet, transfer	1	$ 1.95
Siphon	1	.70
Vial	1	.70

METAL WARE

Pans, assorted	15	$ Varies
Ring stand	12	1.80
Cans, assorted	11	Varies
Screening	8	Varies
Tongs	8	.60
Forceps	7	.26
Support clamp	7	1.75
Wire guaze	7	1.44/doz.
Funnels, metal	6	.19
Spoons	5	.20
Support ring	5	1.05
Tripods	5	1.40
Test tube holder or clamp	4	.18
Trough, pneumatic	4	2.50
Clamps, burette	3	2.75
Clamps, pinch	3	.18
Double boiler	3	3.47
Kettle	3	3.75
Blowpipe	2	.50
Pans, dissecting	2	1.20

Rod, metal	2	$ .35
Skillet	2	2.49
Spatula	2	.75
Box, metal	1	1.85/doz.
Iron bar, soft, 9.5 cm.	1	.35
Plate, metal	1	.50
Spring, metal	1	.35
Spoon, deflagration	1	.26
Tub	1	8.37

TOOLS

Hammer	13	$ 4.25
Knife, paring	12	.39
File, triangular	12	.60
Scissors	9	3.50
Screwdriver	8	.50
Pliers	7	.90
Saw	7	3.50
Tin snips	7	3.00
Brace and bits	5	4.25
Shovel, garden	5	3.98
Trowel, garden	5	.75
Wedge or chisel	5	.85
Cork borer	4	2.75
File, flat	4	.85

Rake, garden	4	$ 2.95
Saw, coping	4	1.75
Vise	4	12.50
Hoe, garden	3	2.98
Mallet	3	1.38
Pliers, needle-nose	3	2.80
Shears, pruning	3	.89
Soldering iron	3	7.20
Glass cutter	2	.95
Knife, pen	2	Varies
Tweezer	2	.29
Wrench, adjustable	2	1.59
Can opener	1	.29
Center punch	1	1.00
Hatchet	1	3.25
Knife, electrician's	1	1.30
Oilstone	1	1.50
Plane	1	4.85
Square	1	1.89

WIRE

Wire, bell	9	$ 2.99/lb.
Wire, iron	6	1.59/lb.
Wire, copper No. 20	3	2.10/lb.
Wire, copper No. 18	2	2.00/lb.

Wire, copper No. 30	2	$ 2.80/lb.
Wire, resistance	2	2.00/4 oz.
Wire, antenna	1	1.75/50 ft.
Wire, assorted for sound	1	.55/spool
Wire, copper, heavily-insulated	1	.10/ft.
Wire, copper No. 26	1	2.50/lb.
Wire, copper No. 24	1	2.40/lb.
Wire, copper No. 22	1	2.36/lb.
Wire, platinum	1	.65/4 cm.

ENVIRONMENTAL MATERIALS

Animal and Animal Supplies

Fish	4
Earthworms	3
Snails	2
Algae	1
Birdfeeder	1
Birdhouse	1
Birdseed	1
Cocoon	1
Fish bowl	1
Hamsters	1
Mice	1
Rat food	1
Rats	1
Tadpoles	1

Collections

Rock	10
Fossil	5
Flourescent minerals	3
Insect	2
Shell	2
Mineral	1
Seed	1

Desk Supplies

Rubber bands	11
String	10
Glue or cement	9
Thumb tacks	8
Crayons	6
Paper clips	6
Scotch tape	6
Blotters	4
Chalk, colored	4
Ink, blue	4
Labels, gummed	4
Paste	4
Pencils	4
Tape, friction	4
Ink, red	3

Stapler	3
Compass, drawing	2
Eraser, pencil	2
Ink, green	2
Protractor	2
Ink, india	1
Ink pen	1
Paper fasteners	1
Paper stars	1
Mailing tube	1
Pen points	1
Staples	1
Wax pencil	1

Foodstuffs

Food coloring	5
Eggs	4
Flour	4
Beef broth	3
Dry yeast	3
Gelatin	3
Lard	3
Nuts	3
Pet food	3
Salad oil	3

Apples	2
Bread	2
Breakfast cereal, dry	2
Butter	2
Candy	2
Carrots	2
Chicken heart	2
Cocoa	2
Crackers	2
Fruit juice	2
Grapes	2
Junket tablets	2
Milk	2
Onion	2
Potatoes	2
Rice	2
Spices	2
Bananas	1
Beef liver	1
Bran	1
Cabbage	1
Celery	1
Chicken foot	1
Coffee	1
Cocoa butter	1

Corn	1
Corn oil	1
Drumstick	1
Meat	1
Popcorn	1
Rhubarb	1
Soda pop	1
Syrup	1

Hardware and Building Supplies

Nails, nuts, bolts, assorted	10
Sand	10
Lumber scraps	9
Gravel	7
Paint	5
Splints, wooden	5
Dowel sticks	4
Paint brushes	4
Sawdust	4
Rope	3
Screw eyes	3
Ball, metal	2
Bricks	2
Copper pipe	2
Lead weights	2
Metal pieces	2

Planks	2
Washers	2
Wheels	2
Aluminum rod	1
Cast iron, piece	1
Crate, wooden	1
Cylinder	1
Filament, light bulb	1
Gasoline	1
Hook, door	1
Hose, garden	1
Iron pipe	1
Kerosene	1
Pumice	1
Punk	1
Putty	1
Radiator	1
Reflector	1
Shavings, wood	1
Shellac	1
Shingles	1
Tire valve	1
Varnish	1

Household Items

Drinking glasses	8
Drinking straws	8
Jars	8
Aluminum foil	7
Light bulbs	7
Fuses	6
Radio parts	6
Sponges	6
Buckets	5
Matches	5
Pipecleaners	4
Plates	4
Refrigerator	4
Saucers and sauce dishes	4
Steel wool	4
Tea kettle	4
Toothpicks	4
Comb, rubber	3
Fingernail polish	3
Fruit juicer	3
Potholder	3
Rubber gloves	3
Soap	3
Sprayer, pint size	3

Appliances, small	3
Broom	2
Coathangers	2
Eggbeator	2
Extension cord	2
Feathers	2
Jugs	2
Molds, gelatin	2
Nutcracker	2
Record	2
Rubber sheet	2
Toothpaste	2
Antifreeze	1
Atomizer	1
Bowls	1
Broomstick	1
Broomstraws	1
Brush, counter	1
Candleholder	1
Catalogues	1
Cider jugs	1
Clay pipes	1
Clock	1
Coasters	1
Cologne	1

Cooking utensils	1
Cream bottle	1
Curtain rods	1
Detergent	1
Dishes, plastic	1
Doorknob	1
Grater	1
Hair	1
Hairbrush	1
Hat	1
Ice tray	1
Kerosene lamp	1
Key	1
Lawn mower engine	1
Magazines	1
Mineral oil	1
Pictures	1
Pillow	1
Pitcher	1
Plastic strips	1
Plunger	1
Rug	1
Shaving soap	1
Shoelace	1
Shoetrees	1

Sifter	1
Toothbrush	1
Umbrella	1
Vegetable peeler	1
Washboard	1
Wax	1
Wick	1

Miscellaneous

Bones	4
Flag	3
Photographic film	3
Menus	1
Tooth, cut in half	1
X-ray film	1

Musical Instruments

Violin	3
Organ pipes	2
Piano	2
Xylophone, eight bars	2
Cymbals, large	1
Organ, mouth	1

Paper

Paper and cardboard, assorted	9
Paper boxes, cardboard	9
Cellophane	6
Sandpaper	6
Paper bags	5
Paper towels	4
Construction paper	3
Milk cartons	3
Ammonium print paper	2
Blueprint paper	2
Carbon paper	2
Newsprint	2
Paper cups	2
Photographic paper	2
Waxed paper	2

Plants and Plant Growing Supplies

Flower pots	11
Sprinkling can	8
Seeds, garden	7
Seeds, flower	6
Soil	6
Plants, house	5
Bulbs, flower	4

Alfalfa	2
Cactus	2
Flats, germinating	2
Plants, water	2
Bark	1
Catalogues, seed and nursery	1
Coleus	1
Fern, moss	1
Flower, white	1
Fungi	1
Geranium	1
Insecticides	1
Lichen	1
Peat moss	1
Straw	1
Vermiculite	1

Sewing Materials and Cloth

Needles, darning	10
Thread	10
Cloths, assorted	9
Needles, knitting	9
Pins, straight	8
Spools	8
Cotton	7

Cheesecloth	6
Bias binding	1
Buttons	1
Cloth bag	1
Doll clothes	1
Mesh bag	1
Rags	1
Razor blade	1
Ribbon	1
Snaps	1
Wiping cloth	1
Yarn	1

Toys

Balloons	12
Ball, rubber	7
Clay, modeling	7
Marbles	6
Musical instruments, toy	5
Balls, ping-pong	4
Top, colored	4
Toys, mechanical	4
Wagon	4
Pinwheel	3
Bicycle	2

Skates	2
Animals, iron, toy	1
Baseball	1
Basketball	1
Jack-o-lantern	1
Kite	1
Sailboat	1
Tennis balls	1
Tube and tire, bicycle	1
Whistle	1

CRITERIA IN THE SELECTING AND ACQUIRING OF SCIENCE EQUIPMENT AND MATERIALS

The title suggests a very wide field and could be a master's report in itself. It is the aim of this section to list some criteria to be considered in the actual selection of two like pieces of equipment or simply, what is the best way to spend the money. It is admitted that the title could suggest criteria which could be used to evaluate the educational value of certain equipment or materials. This kind of criterion, it is assumed by the researcher, was used in forming the lists which were surveyed, although in all cases this may not be true. It would still be wise to evaluate again, before purchasing, the value of an item on purely educational criteria. Therefore this list of criteria of this nature as developed by Harry Milgrom is included.

Learning materials selected for elementary science should:

1. Be real things, whenever possible, rather than representations of real things.

2. Be readily available in school, at home, or in the community.

3. Be easy for children and teachers to assemble and use.

4. Be safe for the youngsters to handle. In most situations, for example, plastic containers and tubing may be used in place of a similar glass material.

5. Be clearly visible to al l concerned.

6. Help satisfy the natural urge of young people to probe and explore.

7. Help the pupils find answers to some of their questions about the world in which they live, through firsthand "doing" experiences.

8. Make the problem on hand more meaningful and be clearly related to it.

9. Help the children grow in their abilities to observe carefully, report their observations and make predictions based upon these observations.

10. Help the pupils develop initiative and resourcefulness in their apporaches to problem solving.

11. Encourage the children to be bold in their use of new materials and techniques.

12. Simplify the complex, for better understanding of basic principles.

13. Be stimulating and challenging so that children will be eager to do more science work in school or at home.

14. Help develop the creative abilities of the youngsters through project planning and construction.

15. Enable the boys and girls to experience the thrill of making "discoveries".

16. Help the children grow in responsibility through experiences with cause and effect relationships. (If you neglect to water a plant it will die.)

17. Give the children the immense satisfaction of finding out that a tentative explanation is correct, or that a homemade device really works.

18. Help the youngsters learn to cope with new and unexpected situations.

19. Help the youngsters become more secure through knowing.

20. Bring to the boys and girls an appreciation of the beauty and rhythm of natural phenomena.

21. Help the children learn to work together in planning and carrying out science activities.

22. Inspire the children to look forward to possible careers in science.[19]

Quality to be desired. There is a place in the science program for both the commercial, the improvised, and the free and inexpensive material. There are still things that need to be considered before an item is acquired. First, the science program should determine the equipment and material needs; the equipment and materials should not determine the science program. Second, there are great differences in quality between items of the same name. Be sure to read specific descriptions and consider carefully the quality needed. Third, safety should be considered. Science programs have been set back by an accident with unsafe equipment. Fourth, can the item be stored and distributed so that it is truly useful to the teacher and pupils?[20]

When selecting free and inexpensive materials, do not acquire just because an item is free. Piltz offers these five questions to guide one.

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[19]Harry Milgrom. On What Bases Should Science Learning Materials be Selected on the Elementary Level?" Science Education, XL (April, 1956), pp. 188-189.

[20]Albert Piltz. "Getting the Most from the Equipment Dollar," Instructor, LXXIII (January, 1964), p. 49.

> Is the advertising motive more obvious than the instructional value? Is material accurate, exaggerated, or biased? Does it fit the intent of the school program? Does it have a specific use in the classroom? Is it appropriate for the maturity of the learner?[21]

When to construct or seek locally. In the master list there are many items of equipment and materials classified as environmental materials. These are materials that can be found in the homes of the children or in the community. In other sections of the master list there a number of items that may be found locally but should be collected and stored in the school if they meet the needs of the educational program. Teachers should not assume too quickly that they can acquire the item when they need it. For instance, soil which was prominent on lists having environmental materials is very hard to acquire when the ground is frozen. Lamp chimneys, which used to be found in many homes and hardware stores, are sometimes difficult to find locally when they are needed.

The researcher, in offering this master list, has not intended that all of the items are necessary for a comprehensive science program, nor that all of the items need to be purchased. The researcher agrees with Piltz when

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[21] Albert Piltz. Science Equipment and Materials for Elementary Schools - Suggestions for Supervisors, Administrators, and Teachers. United States Department of Health, Education, and Welfare, OE 29029. Washington: Government Printing Office, 1961, p. 18.

Piltz states the following:

> There is clearly a place in the science program for both the commercial and improvised equipment. The value of each for its contribution to the educational process must be studied carefully and the determination to purchase or improvise can then be made in relation to program needs and the purposes to be achieved in the learning activities.[22]

A word of warning is appropriate to teachers. Do not become too dependent on contributions of materials by the children since often their contributions are capricious. Having children bring materials to school can not and should not replace basic equipment and materials provided through the budget.[23]

It is of value in the elementary classroom to make simple equipment at times. A water thermometer, a wind vane, a barometer, an anemometer suitable for a beginning study of weather might be constructed by the teacher and children. Nurry states, "Exploring young minds need to create and design; growing muscles need to construct."

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[22]Albert Piltz. "Getting the Most from the Equipment Dollar," Instructor, LXXIII (January, 1964), p. 49.

[23]Albert Piltz. Science Equipment and Materials for Elementary Schools - Suggestions for Supervisors, Administrators, and Teachers. United States Department of Health, Education, and Welfare, OE 29029. Washington: Government Printing Office, 1961, p. 21.

However, he continues and directs that when this type of inaccurate equipment does not satisfy the inquisitive students, it is at this point that "real" science equipment should be introduced.[24]

Other examples from the field of measurements might be considered. A measuring cup is accurate enough for a beginning student, but as the student progresses in scientific skills a graduated cylinder will better satisfy. A balance can be constructed by the children, but later more precise measurements will necessitate a good commercial balance be purchased.

When to buy from science supply houses. There is, as has been stated, a need for both environmental or constructed materials and purchased materials from science supply houses. Two considerations in favor of purchased materials are: (1) Could the teacher use his time more effectively in class preparation than shopping the area for science materials? (2) Could purchased equipment provide a more science-like experience?

Podendorf condensed the arguments on consideration number one (1) in the following quotation:

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[24]Bernard E. Nurry. "Science Equipment-Make It or Buy It?" Pennsylvania School Journal, CIX (April, 1961), p. 329.

> Much has been said on the pros and cons of having teachers and pupils design and improvise their own equipment. The practice does encourage teachers and pupils to be creative. More often, perhaps, it results in a classroom program that uses no equipment. It seems unreasonable to expect teachers to spend the little free time they have making equipment for science class. It is most discouraging for the teacher who has invested precious hours making equipment to find when the time comes to use it, that it does not work....It seems more appropriate to the purpose of elementary-school science programs for the teacher to be able to demonstrate with a piece of equipment in which both teacher and pupils can take pride.[25]

In defense of consideration number two (2) the Council of State School Officers say that although teachers and pupils can make and gather from local sources many science materials, they should have the opportunity of using carefully made accurate instruments and need these instruments to have science-like experiences for the children.[26] Blackwood also believes that most elementary science programs could be improved with the use of more instruments.[27] Both of the above mean by the term, instruments, such items as tuning forks, barometers, scales, thermometers, hygrometers,

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[25]Illa E. Podendorf. "State of the Sciences," Elementary School Journal, LIX (March, 1959), p. 309.

[26]Purchase Guide for Programs in Science, Mathematics, Modern Foreign Languages. Council of Chief State School Officers. Chicago: Ginn, 1959, p. 252.

[27]P. E. Blackwood. "Teaching Elementary Science," School Life, XLIII (February, 1961), p. 13.

and similar pieces of equipment.

"The paper cup and the Pyrex flask are both needed in the elementary classroom."[28]

Considerations in the purchase of selected items. The master list does not and could not specify the amount of a certain item to purchase. This must be determined by each school individually. However, some items that should be purchased in larger quantities than one are magnets, dry cells, bells, switches, prisms, beakers, test tubes, flasks, and funnels. "Such purchasing can make the difference between a satisfying amount of firsthand experience and little to no firsthand experience."[29]

The aquarium which was found on thirteen lists receives special attention from state departments of education. In 1958, although only two states had recommended lists of science equipment for the elementary school, nine states did recommend that an aquarium be part of the science program. The terrarium likewise was recommended by eight

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[28]Bernard Nurry. "Science Equipment-Make It or Buy It?" Pennsylvania School Journal, CIX (April, 1961), p. 329.

[29]Ella E. Podendorf. "State of the Sciences," Elementary School Journal, LIX (March, 1959), p. 309.

states, six of which did not make other recommendations.[30] Consider carefully whether or not to purchase these two items.

Although audio-visual equipment was excluded from the master list, one piece of audio-visual equipment, the microprojector, was included since it is used exclusively in the science program. While the microscope needs to be refocused by each child, or each child needs a microscope to use, the microprojector can project a specimen in focus for the entire class. The teacher can also point to particular features of the specimen being sure that the student will note the desired feature of the specimen.[31] The cost may prohibit the purchase in some schools and perhaps the funds can be used for a larger number of smaller items in others, but this item still merits special evaluation.

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[30]Edgar W. Martin. Facilities and Equipment for Science and Mathematics - Requirements and Recommendations of State Departments of Education. United States Department of Health, Education, and Welfare, OE 21000. Washington: Government Printing Office, 1960, p. 95.

[31]Albert Piltz. Science Equipment and Materials for Elementary Schools - Suggestions for Supervisors, Administrators, and Teachers. United States Department of Health, Education, and Welfare, OE 29029. Washington: Government Printing Office, 1961, p. 23-24.

After reviewing the master list, one might consider the purchase of a science kit the answer to acquiring those items most recommended. Piltz warns that the cost is likely to be more if the kit is purchased than if the same items were purchased individually. Other factors to consider are specifications, quality, serviceability, maintenance, replacement needs, and extent of use.[32] Lange and Payne state that abuses accompany the use of kits. Two of these abuses are that they are not used at all or they are used indiscriminately; the teacher does all the experiments whether applicable or not.[33]

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[32]Albert Piltz. "Getting the Most from the Equipment Dollar," Instructor, LXXIII (January, 1964), p. 80.

[33]Erwin F. Lange and K. E. Payne. "Science Kits in Elementary Science Teaching," Science Teacher, XXV (October, 1958), p. 321-323.

SUMMARY AND RECOMMENDATIONS

The review of literature showed that good science teaching if it was to be effective must include firsthand experiences for the students and that these firsthand experiences for the student depended upon adequate science equipment and materials. What was adequate depended upon the scope and content of the science program in the individual school and the capabilities of the teachers.

Although science educators, state and city departments of education, and textbook companies provide lists of equipment which they believe necessary for a comprehensive science program, these lists do not agree fully in content nor do any of them give a guide to the school administrator which items of the lists are most useful and should be purchased first. This has led to rather arbitrary purchases in some schools.

The chief purpose of this report then was to reduce fifteen such lists of science equipment and materials to a single master list, to score the number of times that a single item appeared on the fifteen lists, and to provide an approximate price for items purchased from science supply houses. It was assumed that items which appeared on the most lists should have priority in the purchasing schedule of a school.

Any purchase by a school should be such that it helps carry out the objectives of the science curriculum. The curriculum should not be molded to fit the equipment. There is a place for both improvised materials and purchased materials. The particular teacher must determine which is more appropriate.

In the use of the master list it is recommended that a school evaluate its present science equipment and materials in reference to those items in each division which were found to be most important. After this evaluation the school should purchase those items of high recommendation which they do not have. In any one year the purchase of materials should probably provide some new materials from each area unless the school's evaluation shows a preponderance of equipment or materials in one area. The size of the school, the amount of equipment and materials already in the school, the value of the science program in the eyes of the community, the size of the science budget, and other factors will determine whether the school acquires all items which scored ten times, or all the items which scored five times, or perhaps even all of the items on the master list.

The lists used had in them some seeming inconsistencies which in turn may be noted by the reader in the master list. One such inconsistency is that thirteen lists had miniature light sockets on them, but only seven mentioned

light bulbs to put in the sockets. Since inconsistencies do exist, the researcher cautions that before purchasing an item consider what other pieces of equipment might have to be purchased to make use of the first item.

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SCIENCE EQUIPMENT AND MATERIALS FOR A COMPREHENSIVE ELEMENTARY SCIENCE PROGRAM WITH A PLAN OF PURCHASE

by

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Purchases to provide science equipment and materials should be made so that most usable items are purchased first, making the best use of the patron's money. The researcher, believing in the above statement, searched for a list that would provide such a guide in literature and wrote departments of education and textbook companies to obtain the same. Although a number of science equipment and materials lists were obtained none of the acquired lists indicated the best order of purchase. Therefore, the researcher adopted as the purpose for this report to develop a list that could be used as a purchase guide for science equipment and materials on an item basis rather than buy everything on a given list or in a given science kit.

The procedure used was this: fifteen lists, five of science educators, five of state and city departments of education, and five of textbook companies, which were then condensed into a single master list. This list was subdivided into major areas of science instruction and environmental materials. The items of all subdivisions were placed in order of those appearing on the most lists. The number of times an item appeared on the lists is noted as is also an approximate price that one can expect to pay for the individual item if supplied by a science supply house.

The researcher assumed that those items appearing on the most lists should be purchased first. It was recognized

that a school will not approach the list having no equipment. Therefore, each school will have to evaluate its present equipment as compared with the master lists and then make judgments concerning succeeding purchases. No purchase should be made if it does not fit the objectives of the science curriculum of the school.

It was noted that the usefulness of any piece of science equipment depends ultimately on the teacher. There is still a place for both purchased and improvised materials.

Items given special consideration were aquariums, terrariums, microprojectors, and science kits. Items appearing on ten or more lists of the fifteen are:

Alcohol burner
Aquarium
Balance, spring
Balloons
Barometer, aneroid
Barometer, mercury
Beakers
Bell, electric
Bunsen burner
Candles
Cans, assorted
Compass
Cylinder, graduated

File, triangular

Flashlight

Flower pots

Glass tubing

Hammer

Hot plate

Iron filings

Knife, paring

Lights, miniature sockets

Litmus paper

Magnet, bar steel

Magnet, horseshoe

Medicine dropper

Microscope, elementary

Mirror, plane

Nails, nuts, bolts, assortment

Needles, darning

Pans, assorted

Paraffin

Prism

Pump, force air

Reading glass

Ring stand

Rubber bands

Rubber stoppers

Rubber tubing

Salt

Sand

Slides, microscopic

Stop watch

String

Support, test tube

Switch, push-button

Terrarium

Test tubes

Thread

Tuning forks

No such list can be considered perfect, but it is hoped that this will aid schools in the future to make better planned purchases.